

Evaluation of the energy recovery potential of thermoelectric generators in diesel engines

Rafael Ramírez, Alexis Sagastume Gutiérrez, Juan J. Cabello Eras, Karen Valencia, Brando Hernández, Jorge Duarte Forero

Abstract

Thermoelectric generation is an alternative to recover some of the wasted energy through an exhaust of the internal combustion engines. This paper assesses the performance of a thermoelectric generator with 20 modules by implementing a waffle heat exchanger. Experimental results showed a variable range of power recovery from 57.87 W to 71.13 W for B10, B5, and Diesel. The highest energy conversion efficiency of the aforementioned thermoelectric device was of 3% with the highest load and the fastest rotational speed. Also, the recovery process reduced gaseous emissions such as CO, CO₂, NO, NO_x, and HC. Additionally, the smoke opacity per kWh is reduced at significant levels of operations such as 2.42% when using diesel, 2.65% when using B5 and 3% when using B10. However, when using biodiesel blends, NO_x emissions were increased. Overall the biodiesel resulted in a higher power recovery performance versus the diesel.

Keywords

Energy recovery, Heat exchanger, Thermoelectric generator, Thermoelectric module, Internal combustion engine.